



## Novel alpine algae from New Zealand: Cyanobacteria

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### Abstract

Five new species of cyanobacteria, *Scytonematopsis maxima*, *Tolypothrix pseudorexica*, *Hormoscilla irregularis*, *Phormidium arthurensis*, and *Godleya alpina*, the last belonging to a new genus, are described from cultured material isolated from the alpine zone of Mt Philistine, New Zealand. *Tolypothrix pseudorexica* resembles *Rexia erecta* in formation of upright trichomes on agar, but clearly lacks the ability to divide in two planes that is characteristic of the latter species. *Godleya* displays characteristics of the Scytonemataceae—ispolar hormogone development and binary branching—but groups with a species of *Coleodesmium* (Microchaetaceae) in analyses of 16S rDNA, despite its morphological differences, thus conflicting with the current classification system. We also show that material referable to the widely reported species *Phormidium autumnale* is found in the New Zealand alpine zone; molecular data indicate that this is likely the same organism reported recently from the Hutt River, Wellington, New Zealand, a quite different habitat. In this site, a lowland river, the species may form extensive mats. These have not been seen on Mt Philistine.

**Key words:** biogeography, blue green algae, extremophiles, *Godleya*, new species

### Introduction

Alpine algae throughout the world are poorly known. In New Zealand, some taxonomic work has been carried out on eukaryotic isolates (Novis 2002, Novis *et al.* 2008). Work on cyanobacteria has been more limited, with a publication on a new species of *Placoma* (Broady & Ingerfeld 1991) and the inclusion of cyanobacteria in the checklist of plants of Mt Cook National Park (Wilson 1976) as the main contributions. Studies of these organisms are potentially very interesting biogeographically, given the relative proximity of New Zealand's alpine zone to Antarctica, and reports of the same cyanobacterial species in both areas (e.g. Broady & Ingerfeld 1999).

Mt Philistine, Arthur's Pass National Park, has been a focus of previous work on alpine algae (for more details about this locality, see Novis 2002). Here, we describe six new strains from Mt Philistine, which include four new species and one new monospecific genus.

### Methods

#### *Specimen collection, culture, and examination*

Unialgal cultures of alpine cyanobacteria were obtained from a collection site at 1640 m on Mt Philistine, Arthur's Pass National Park, New Zealand (42°53'20.189"S, 171°32'08.460"E). Cultures were grown on washed, agarised 10% BG-11 medium (Rippka *et al.* 1979) at 12°C under illumination of approximately 150  $\mu\text{mol photons m}^{-2} \text{s}^{-1}$ . Isolates were purified using standard aseptic microbiological techniques, and photomicrographs were obtained using a Leica DC500 digital camera mounted on a Leica DMLB compound microscope with Nomarski differential interference contrast optics.